

mathematical theory, the 21-constant hypothesis is as legitimate as its rival and conversely; the question that interests physicists is which of the two, if either, best corresponds to the properties of elastic bodies. Saint-Venant rightly argued that this could not be settled *a priori*, but only by experiment; and at the present day his justification on this point is complete, although he was led to adopt the rari-constant theory by relying upon inconclusive experiments. As Prof. Love points out (pp. 14, 15) our views of the ultimate structure of matter are being profoundly modified, and until they are cleared up it is premature to propose an "atomic" theory of elasticity. Meanwhile we can make a working hypothesis by assuming the existence of a strain-energy-function which is a quadratic function of the components of strain. In all probability the ultimate theory, if we could only reach it, is kinematical; the stresses set up in a strained body being an aspect of a new distribution of kinetic energy in space.

The results of the theory, as applied to the arts, are, of necessity, only approximate; and great care must be taken to see that, when an approximate solution has been obtained, it is really applicable to the concrete case. An excellent example is given on p. 140, relating to a sphere strained by its own gravitation. If we put in the numerical values of  $g$ ,  $r_0$ ,  $\rho$ , and any reasonable values for  $\lambda$ ,  $\mu$ , when the sphere in question is the earth, we find that the condition that  $U/r$  should be small for  $r_0 > r > 0$  cannot be satisfied, although this is one of the assumptions on which  $U$  has been calculated. This point was brought out in the previous edition (i. 220); it is a pity that this warning has been suppressed, though another, equally instructive, has been given.

Again, take the condition (or conditions) for rupture taking place (pp. 117 *sqq.*). This cannot be given by the ordinary theory, which is only applicable when the elastic limit is not exceeded. Nevertheless, attempts have been made to express the condition in terms of the components of stress. This is entirely illogical, and hence, as usual, a contest between rival formulæ. It may, of course, happen that one formula, as against the other, may have a wider range of applicability; but it ought to be treated as purely empirical, and not rashly applied to untested cases. On this point the author might have been more dogmatic than he is.

A very interesting section is that on the deformation of plates. This is a famous problem, historically, and even lately gave rise to a controversy, now satisfactorily settled. To get a reasonably simple approximate solution some kinematical assumption must be made, and this must be compatible with the boundary conditions. Prof. Love pointed out that, strictly speaking, a vibrating plate with free edges cannot satisfy the condition that the middle surface is unstretched; Mr. Basset and Prof. Lamb showed that the boundary condition could be satisfied without supposing any considerable stretching except near the edge. An interesting statical illustration due to Lamb is given on p. 521. On p. 506 Prof. Love obtains, by a method of his own, second approximations for

stress and strain in a curved shell, agreeing to that order with results of Mr. Basset's.

In this, as in other parts of the book, the analysis is very elegant, and is given in sufficient detail for really competent readers to follow. But the author follows the general tendency now in vogue, of suppressing details of calculation, and emphasising results of practical value, rather than examples of mainly æsthetic interest. In his preface he expresses a hope that his book will be useful to engineers; how far they do so depends, of course, upon them as well as upon him. They will find among the subjects treated the buckling of plates, the collapse of boiler-flues, the whirling of shafts, the stability of slender columns, and other such things; it is to be hoped that they will also appreciate the general theory, as the author presents it. Every student, not an expert, should follow the advice given in the preface of proceeding to chapter v. as soon as possible.

It is a great advantage that the author of this book is a mathematician of wide as well as accurate attainments. As an illustration, it will be enough to refer to p. 306, dealing with the torsion of a rectangular prism; it is at once clear that the author's knowledge of Fourier expansions is quite different from that of the average physicist. Similar examples of rigour free from pedantry may be found throughout the volume.

At the end of the introduction occurs the sentence: "Most of the men by whose researches it [the mathematical theory of elasticity] has been founded and shaped have been more interested in Natural Philosophy than in material progress, in trying to understand the world than in trying to make it more comfortable." It may be added that most of the comfort we enjoy, and most of our civilisation that is worthy of the name, is due to men who have endured discomfort, in pursuance of ideal ends. Apart from the poets and the philosophers, where should we be?

G. B. M.

#### PROTEID CHEMISTRY.

*Chemistry of the Proteids.* By Dr. Gustav Mann. Based on Prof. Otto Cohnheim's "Chemie der Eiweisskörper." Pp. xviii+606. (London: Macmillan and Co., Ltd.; New York: The Macmillan Co., 1906.) Price 15s. net.

DR. GUSTAV MANN started this work with the modest idea of producing an English translation of Prof. O. Cohnheim's well-known monograph on the chemistry of the albuminous substances. But it has developed into a volume of a much more ambitious nature, and has culminated in a book twice the size of that on which it is founded. The subject in many parts is treated much more fully, and a good deal of new matter introduced. In many places, moreover, Cohnheim's own views are adversely criticised, so that the present volume bears witness to the originality of the English author.

Those who know Dr. Mann best as a histologist may be surprised that he should have the necessary knowledge to write on a subject at first sight so far

removed from the microscope. His previous book on Physiological Histology has, however, shown the connection between the two. The fixing action of preservatives on tissues, the staining reactions of cells and nuclei, are ultimately chemical in nature, and much of macro-chemistry can be learnt from micro-chemistry. Dr. Mann's sympathies are mainly physiological, not anatomical. Physical chemistry also is more than a hobby with him, and the sections relating to speculations of a physico-chemical nature form pleasant oases in what as a rule is rather solid reading. His histological proclivities have led him in some cases to devote a good deal of space to subjects which some might regard as of secondary importance—for instance, his lengthy description of the interactions of proteids with mercury compounds evidently springs from the extensive use he has made of corrosive sublimate as a fixative.

Cohnheim's book in the original state cannot be described as an ideal one. It lacks the imaginative faculty, and reflects the stolid, plodding German worker, anxious to omit no reference to literature that can possibly be dragged into a footnote. To some investigators this is of course advantageous; they will profit by the diligence of the author, and easily be able to consult the memoirs quoted in reference to any special point they are interested in. But to the student who desires to obtain a general insight and a wide outlook on the general relationships of the subject, this compression of material is a distinct hindrance; he will be apt to lose sight of the wood on account of the trees.

Dr. Mann follows on very much the same lines, and though it is impossible to restrain one's admiration for his labours in hunting up literature, quoting authorities as far back and as far forward as possible, one cannot but regret that the text does not as a consequence run easily, and most of it will form stiff reading even for advanced students. In some places the pages abound with chemical formulæ without a sufficient guidance in words. Here, again, anyone but an accomplished organic chemist will have difficulty in finding his way along.

Dr. Mann also has certain mannerisms of style, but one does not complain of these unduly, for they stamp the pages with the author's individuality; but there is one of these faults which many will find annoying and even confusing, and that is a looseness and inexactitude in the use of terms. For instance, on the title-page we find the word "proteid" used as a general expression for all the albuminous substances; within the pages of the book "proteid" is employed only for a certain group of these materials. Albumin also is sometimes used as a generic term, and at other times applied to a specific group; sometimes it is used as opposed to globulin, sometimes it includes the globulins, and sometimes it includes everything. In one place we read that lactalbumin is one of the few true albumins; on another page it is alluded to as a hypothetical substance. The author has dedicated his work to his father; and in the dedication tells us something of his father's life-work. It would be interesting to know something

more about his ancestry—whether, for instance, he has any Irish blood in him. The use of the expressions "true pseudo-acid" and "true pseudo-base" is distinctly Hibernian.

The same kind of carelessness is shown in the spelling. Albumin is sometimes spelt with an *i*, sometimes with an *e*. The nomenclature committee of the Chemical Society tried to introduce uniformity into spelling, and assigned certain meanings to certain terminations. A word ending in *ine*, for instance, means an alkaloidal material; a word ending in *in* does not; similarly, the terminations *ol* and *ole* have a distinct chemical significance. But Dr. Mann has paid no attention to such rules. "Vitellin," for example, is sometimes spelt with, sometimes without, a final *e*. "Gelatine" and "cholin" are spelt as just printed in direct contravention of the rules of the Chemical Society. The names of investigators are also often mis-spelt; Waymouth Reid, Curtius, Claude Bernard, and Lane-Claypon are among the sufferers.

The whole question of nomenclature in chemistry is very difficult, especially in translations. It is hopeless to try to reconcile English with German usages, but there ought to be an attempt on the part of English writers to adopt some sort of uniformity. This difficulty is accentuated in relation to proteid nomenclature, and one can only hope that the joint committee of the Physiological and Chemical Societies now sitting on this very subject may put forward some practicable suggestions. Dr. Mann is therefore not wholly to blame for his misdeeds.

In spite of the blemishes to which I have devoted so much space, I believe the book will have a useful career in front of it. Its many excellences can be discovered by reading it and using it, and Dr. Mann is to be congratulated in having produced such a valuable addition to scientific literature.

W. D. H.

#### STATISTICAL SEISMOLOGY.

*Les tremblements de terre. Géographie Séismologique.* By Comte F. de Montessus de Ballore; with a preface by Prof. A. de Lapparent. Pp. v+475. (Paris: Armand Colin, 1906.) Price 12 francs.

WITH the growth of their science seismologists have become more and more specialised, and devoted themselves to the cultivation of a limited portion of their domain, but none have marked out for themselves a more clearly defined plot, or cultivated it with greater assiduity, than the Comte de Montessus de Ballore. Leaving to others the study of the nature and effect of earthquakes, he has confined himself to the consideration of their cause, and attacked the problem by the statistical way, believing that a detailed study of the distribution of earthquakes in time and space will most conclusively indicate their cause. By no means the first cataloguer of earthquakes in point of time, for the great lists of Mallet and Perrey are well known, to say nothing of the numerous local catalogues compiled by others, our author stands preeminent in the number of earth-